UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

*2339708426*

**CHEMISTRY** **0620/02**

Paper 2 **May/June 2007**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials required.

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, Candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may need to use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

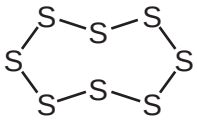
Answer **all** questions.
A copy of the periodic table is printed on page 16.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

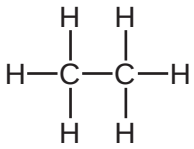
| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| Total | |

This document consists of **15** printed pages and **1** blank page.

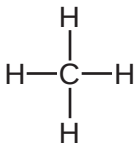
**1** The structures of some elements and compounds are shown below.



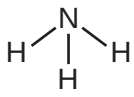

**A**



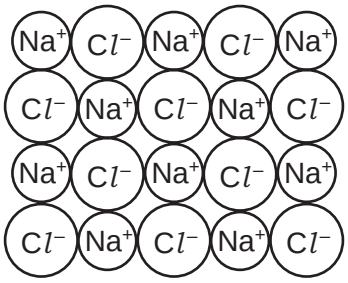

**B**



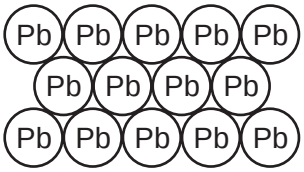

**C**




**D**




**E**




**F**

**(a)** Answer these questions using the letters **A** to **F**.

**(i)** Which structure is ethane? ..... [1]

**(ii)** Which structure contains ions? ..... [1]

**(iii)** Which structure is a gas that turns moist red litmus paper blue? ..... [1]

**(iv)** Which structure is sodium chloride? ..... [1]

**(v)** Which structure is the main constituent of natural gas? ..... [1]

**(vi)** Which **two** structures are organic compounds? ..... [1]

**(vii)** Which **two** structures are elements? ..... [1]

**(b)** Structure **F** is lead.

**(i)** What is the source of the small amount of lead present in the air?

..... [1]

**(ii)** State an adverse effect of lead on health.

..... [1]

**(c)** Structure **A** is sulphur. Explain why burning fossil fuels containing sulphur is harmful to the environment.

.....

..... [2]

[Total: 11]

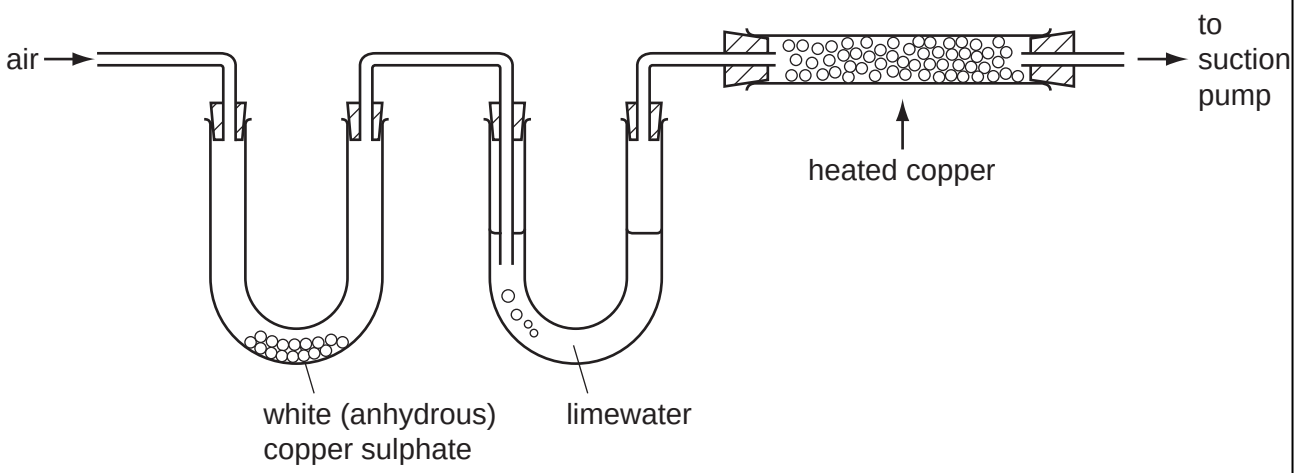
**2** Clean air contains a number of different gases.

**(a)** State the names of the **two** gases which make up most of the air.

.....

[2]

**(b)** A sample of air is drawn through the apparatus shown below.




**(i)** When the air is drawn through the apparatus, the lime water turns milky. Which gas turns lime water milky?

.....

[1]

**(ii)** The white (anhydrous) copper sulphate turns blue. State the name of the substance which turns white copper sulphate blue.

.....

[1]

**(iii)** Oxygen is removed from the air by passing it over heated copper.
Complete the equation for this reaction.

$$2Cu + \text{.....} \rightarrow \text{.....} CuO$$

[2]

**(c)** Pure air contains about 1% argon.

**(i)** In which Period of the Periodic Table is argon?

..... [1]

**(ii)** State the **name** of the Group of elements to which argon belongs.

..... [1]

**(iii)** Draw the electronic structure of argon.

[1]

**(iv)** Why is argon used in lamps?

..... [1]

**(v)** An isotope of argon has a mass number of 40.
Calculate the number of neutrons in this isotope of argon.

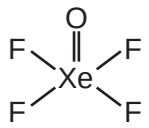
..... [1]

**(d)** A small amount of xenon is present in the air.
A few compounds of xenon have been made in recent years.

Calculate the relative molecular mass of xenon difluoride, $XeF_2$.

[1]

**(e)** The structure of another compound of xenon is shown below.




**(i)** Write the simplest formula for this compound of xenon.

..... [1]

**(ii)** Describe the type of bonding in this compound.

..... [1]

[Total: 14]

**3** Hydrogen is a fuel which can be obtained from water by electrolysis.
Petrol is a fuel obtained by the fractional distillation of petroleum.

**(a) (i)** Complete the equation for the burning of hydrogen.

..... $H_2 + O_2 \rightarrow$ ..... $H_2O$ [1]

**(ii)** Suggest why hydrogen is a renewable source of energy.

..... [1]

**(iii)** When hydrogen is burnt, heat is given off. State the name of the type of reaction which gives off heat.

..... [1]

**(b)** Petrol is a mixture of alkanes.
One of the alkanes in petrol is octane, $C_8H_{18}$.

What products are formed when octane is completely burnt in air?

..... [2]

**(c)** Petrol is only one of the fractions obtained from the fractional distillation of petroleum.
State the name of two **other** fractions obtained from the distillation of petroleum. Give a use for each of these fractions.

fraction .....

use .....

fraction .....

use ..... [4]

**(d)** More petrol can be made by cracking less useful petroleum fractions.

**(i)** What do you understand by the term *cracking*?

.....

[1]

**(ii)** State **two** conditions needed for cracking.

.....

[2]

**(iii)** Alkenes can be formed by cracking. The simplest alkene is ethene.
Draw a diagram to show the structure of ethene.
Show all atoms and bonds.

[1]

[Total: 13]

**4** Catalysts are often used in industry.

**(a) (i)** What do you understand by the term *catalyst*?

.....

[1]

**(ii)** Which type of metals often act as catalysts?

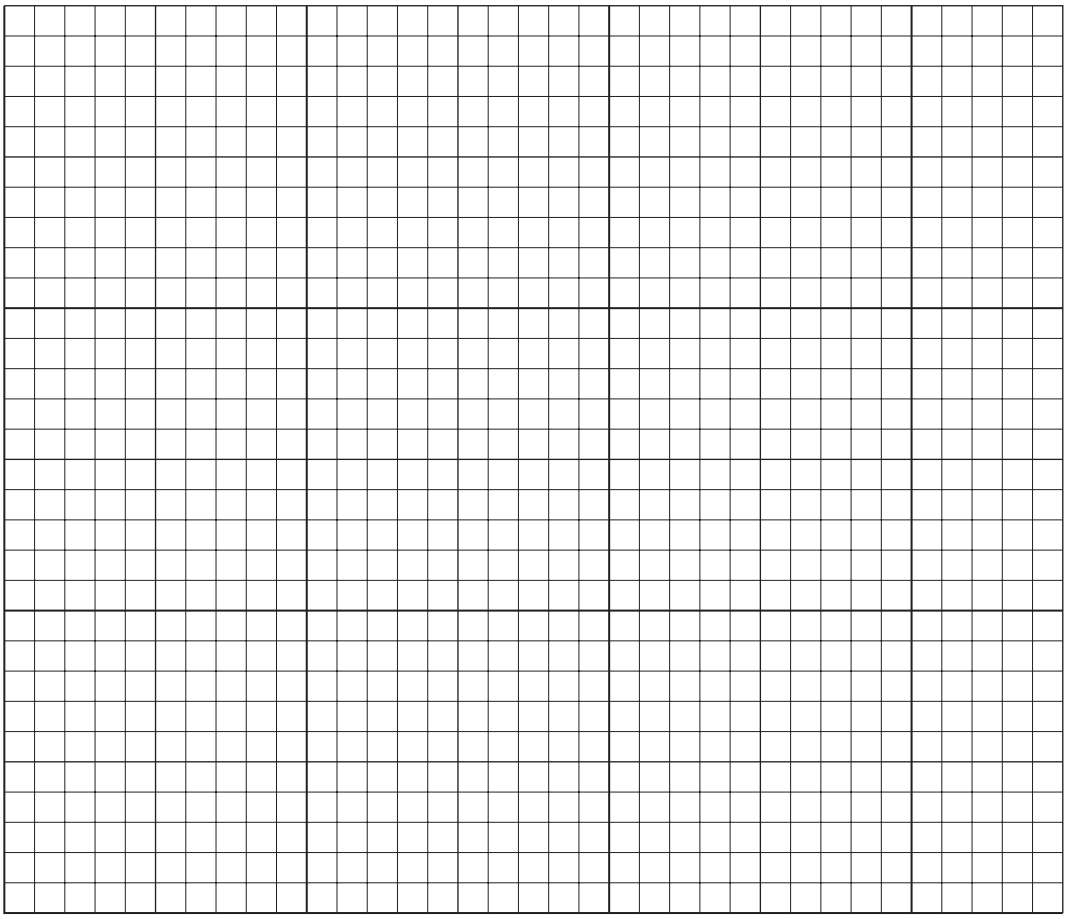
.....

[1]

**(b)** A student measured the volume of hydrogen gas produced when a few large pieces of zinc reacted with hydrochloric acid of concentration 2.0 mol / $dm^3$. The hydrochloric acid was in excess.
The results are given in the table.

| time / minutes | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|---|---|
| volume of hydrogen / $cm^3$ | 0 | 27 | 54 | 81 | 100 | 110 | 110 |

**(i)** Plot a graph of volume of hydrogen against time on the axes below. Label the axes.



[4]

**(ii)** Copper ions catalyse the reaction between zinc and hydrochloric acid.
On the axes above, sketch the line you would expect for the catalysed reaction.
Label this line **C**. [2]

**(iii)** Explain why no more hydrogen is given off after 50 minutes.

..... [1]

**(c)** What would happen to the speed of the reaction if

**(i)** small pieces of zinc were used instead of large pieces,

..... [1]

**(ii)** the concentration of hydrochloric acid was $1.0\,\text{mol}/\text{dm}^3$?

..... [1]

**(d)** The equation for this reaction is

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

**(i)** State the name of the salt formed in this reaction.

..... [1]

**(ii)** Describe a test for hydrogen.

test .....

result ..... [2]

[Total: 14]

**5** Some sunglasses are made from glass which darkens in bright sunlight. The glass c tiny crystals of silver chloride and copper(I) chloride.

**(a)** In bright sunlight, in the presence of copper(I) chloride, the silver chloride breaks down to solid silver which darkens the glass.

$$Ag^{+}(s) + e^{-} \rightarrow Ag(s)$$

State the name of the particle with the symbol $e^{-}$.

.....

[1]

**(b)** Silver is a metal. State **two** physical properties which are characteristic of all metals.

.....

.....

[2]

**(c)** In bright sunlight, the copper(I) chloride in the sunglasses is converted to copper(II) chloride.
What do the roman numerals (I) and (II) show in these copper compounds?
Tick one box.

| | |
|---|---|
| the number of atoms of copper in the copper compounds | ☐ |
| the number of neutrons in the copper compounds | ☐ |
| whether the copper is in the solid, liquid or gaseous state | ☐ |
| the oxidation state of the copper in the copper compounds | ☐ |

[1]

**(d)** Describe a test for aqueous copper(II) ions.

test .....

result .....

.....

[3]

**(e)** Give a common use of copper.

.....

[1]

[Total: 8]

**6** The halogens are a group of elements showing trends in colour, state and reactio other halide ions.

**(a)** Complete the word equation for the reaction of chlorine with aqueous potassium bromide.

chlorine + potassium bromide → .....+ ..... [2]

**(b)** Explain why an aqueous solution of iodine does not react with potassium chloride.

..... [1]

**(c)** The table shows the properties of some halogens.

| halogen | state at room temperature | colour | boiling point / °C | density of solid / g $cm^{-3}$ |
|---|---|---|---|---|
| fluorine | gas | yellow | | 1.51 |
| chlorine | | green | −35 | 1.56 |
| bromine | liquid | red-brown | 59 | |
| iodine | solid | | 184 | 4.93 |

**(i)** Complete the missing spaces in the table. [2]

**(ii)** Suggest values for

the boiling point of fluorine, .....

the density of bromine. ..... [2]

**(d)** How many electrons does an atom of fluorine have

**(i)** in total, .....

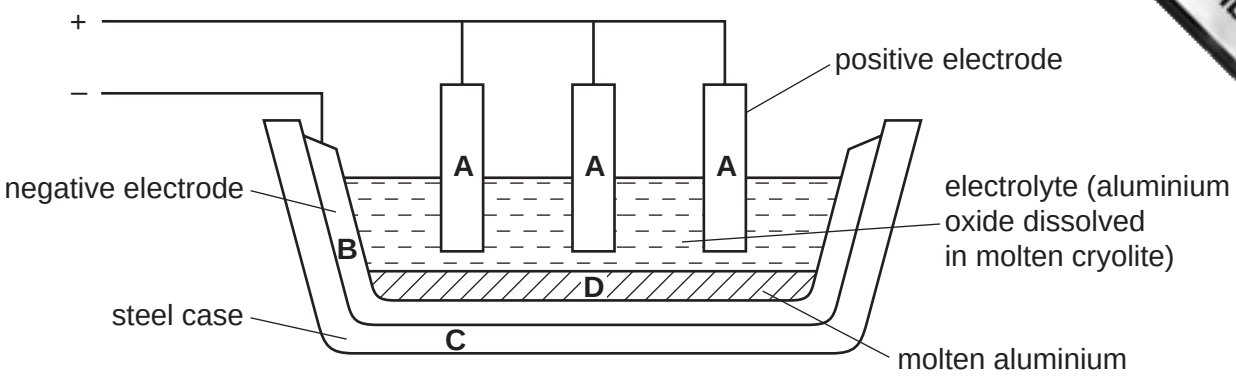
**(ii)** in its outer shell? ..... [2]

**(e)** State a use for chlorine.

..... [1]

[Total: 10]

**7** Aluminium is extracted by the electrolysis of aluminium oxide dissolved in cryolite.




**(a)** What information in the diagram shows that aluminium is more dense than the electrolyte?

.....

[1]

**(b)** What form of carbon is used for the electrodes in this electrolysis?

.....

[1]

**(c)** Which letter in the diagram, **A**, **B**, **C** or **D**, represents the anode?

.....

[1]

**(d)** Suggest why electrolysis is used to extract aluminium rather than reduction using carbon.

.....

[1]

**(e)** Oxygen gas is released at the anode.

**(i)** Where does this oxygen come from?

.....

[1]

**(ii)** The oxygen reacts with the carbon anode to form carbon dioxide.
What is the formula of carbon dioxide?

.....

[1]

**(iii)** Why does the anode decrease in size during electrolysis?

.....

[1]

**(f)** Each electrolysis cell makes 212 kg of aluminium per day from 400 kg of alu oxide.
Calculate how much aluminium can be made from 1 tonne (1000 kg) of aluminiu oxide.

[1]

**(g)** Complete the following sentences about the electrolysis of aluminium oxide using words from the following list.

**atoms gaseous molten solid ions molecules**

Aluminium oxide conducts electricity when it is ..... because it contains ..... which are free to move. [2]

[Total: 10]

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# DATA SHEET
## The Periodic Table of the Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | III | IV | V | VI | VII | 0 |
| | | | | | | | 1 H Hydrogen 1 | | | | | | | | | 4 He Helium 2 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulphur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | Po Polonium 84 | At Astatine 85 | Rn Radon 86 |
| Fr Francium 87 | 226 Ra Radium 88 | 227 Ac Actinium 89 † | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | Pa Protactinium 91 | 238 U Uranium 92 | Np Neptunium 93 | Pu Plutonium 94 | Am Americium 95 | Cm Curium 96 | Bk Berkelium 97 | Cf Californium 98 | Es Einsteinium 99 | Fm Fermium 100 | Md Mendelevium 101 | No Nobelium 102 | Lr Lawrencium 103 |

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).